


Ethics, Education and Machine Intelligence

Zorislav Šojat

Ruder Bošković Institute, Centre for Informatics and Computing, Zagreb, Croatia,

 <https://orcid.org/0000-0002-3772-7807>

Gordana Gredičak Šojat

Light Art by Gordana & Zorislav Shoyat, Zagreb, Croatia

Abstract: The sudden, unexpected breakthrough in the intelligence shown by machines, as a wished for, but very disruptive element, will shape the future of our civilisation and Humans as individuals and collectives. The extreme drive towards commercialisation of newest developments already led to an extremely wide spread of Machine Intelligence Assistants (and chatbots), with plans of many companies to include them into everything they produce. This puts Humans in a very precarious situation, specifically regarding ethics and morale, trustworthiness and confidence. Suddenly we found ourselves in a situation that Education has to be extended to cater for two types of intelligences: the Humans and the Machines. On the Machine side, it has been shown that it is very difficult to obtain a trustworthy and highly ethical non-biased intelligence. The present day approach of “training” the “models” must be overcome by the realisation that MI is based on collected Human knowledge, but initially “trained” without any regard to the order of learning, which directly influences the initial alignment of the emerging intelligence, the same way learning does in Humans. On the Human side, it is getting obvious that this disruptive development was generally completely unexpected, and no educational preparation was ever envisioned for this situation. However, between others, a good example of possible positive cooperation of Humans and Machines, which necessitates proper MI ethics, is Democratisation of Academic Publishing, where, based on blockchain trustworthiness, Open Access publishing is done in such a way that all stakeholders in the process get appropriate recognition and reward. The use of well educated Ethical Machine Intelligence in this process of management of an enormous amount of academic work and peer reviews will enable academic education and scientific development to be ethical, transparent, fair, trustworthy and accessible to all authors and readers throughout their life.

Keywords: Ethics, Machine Intelligence, Human Education, Machine Education, Academic Publishing

Citation: Šojat, Z. & Gredičak Šojat, G. (2023). Ethics, Education and Machine Intelligence. In M. Koc, O. T. Ozturk & M. L. Ciddi (Eds.), *Proceedings of ICRES 2023-- International Conference on Research in Education and Science* (pp. 1812-1823), Cappadocia, Türkiye. ISTES Organization.

Introduction

What happened, and happens, in the last very few years is that suddenly all those little developments, which

actually came through ages of cumulating knowledge, started streaming together into something which was wished for, but is actually a very disruptive element in our civilization, and it will shape the civilization as we know it as individuals, us humans, and as a collective. This new development is the emergence of machine intelligence or, perhaps even better named - electronic brains (a very old fashioned name for computers, used approximately until mid 1970-ies). However, for modern use, in the sense of emerging machine intelligence, it has quite a lot of sense.

What actually happens is that now, in our present state as a civilisation, have a kind of extremely widespread need to commercialise anything freshly invented or achieved, without considering thorough investigation into the possible threats and consequences (both positive, and especially negative) on short and long term human development. So, by this "need" to commercialise as soon as possible, the spread of these intelligent machines, which can already now, in June 2023, do quite a lot of things, is enormous, and the speed by which it happens is measured actually in weeks and even in days.

Table 1. A non-exhaustive list of presently available Large Language Models

GPT-4	Microsoft Dynamics 365	Azure OpenAI Proxy
ChatGPT	Copilot	bloop
DALL-E 2	Microsoft Power Platform	bot-on-anything
Whisper	Copilot	Chart-GPT
New Bing	Microsoft Security Copilot	Chat
Bing Image Creator	Xmind Copilot	chatGPTBox
LLM	Auto-GPT	ChatGPT-CodeReview
Google Bard	MiniGPT-4	chatGPT-discord-bot
Claude	GPT4All (multiple LLMs)	ChatGPT-Next-Web
HuggingChat	DeepSpeed	chatgpt-teams-bot
Adobe Firefly	TaskMatrix (Visual	chatgpt-telegram
Midjourney	ChatGPT)	chatgpt_telegram_bot
Stable Diffusion	Semantic Kernel	chatgpt-wechat-bot
ERNIE Bot	Cursor	chatgpt-wechat-public-account
Tongyi Qianwen	Ghostwriter	nt
ChatGPT plugins	Amazon CodeWhisperer	Dingtalk-OpenAI
Copilot	CodeGeeX	Feishu-OpenAI
GitHub Copilot	Tabnine	gerev
Microsoft 365 Copilot	Visual Studio IntelliCode	gpt4-pdf-chatbot-langchain

As a consequence of both commercialisation, and the Internet philosophy of open accessibility, in this case the drive towards accessibility of open-source and diverse types of open or academic free licenses, there is already now quite a huge amount of different types of so-called "chatbots", i.e. GPTs (Generative Pre-trained Transformer, a recently evolved generic name for Transformer type Large Language Models, first introduced by (Vaswani, 2017)). This is actually a quite sudden (and definitively unexpected) breakthrough / development. According to a quite recent survey from 2016, published 2017, the aggregate predictions were that HLMI (High Level Machine Intelligence - MI as humans or better in all fields) will be achieved in 28 years (i.e. in 2044) according to Asian respondents, and in 74 years (i.e. in 2090) according to North American respondents (Grace, et al., 2017). Though part of these predictions are also predictions of Robots / Machine Intelligences being able to perform any Human job, for many particular tasks, e.g. "translating languages (by 2024), writing high-school

essays (by 2026), driving a truck (by 2027), working in retail (by 2031), writing a bestselling book (by 2049), and working as a surgeon (by 2053)", recently developed electronic brains (MI) are fully, or at least partly capable of human-quality performance (translation, text-to-speech-to-text, writing programmes, solving problems, passing the Multistate Bar Exam better than average students etc. (Ankit, 2023), or Robots performing extreme exercises, like the Boston Dynamics Atlas (Boston Dynamics Atlas,) and others).

Towards Ethical Intelligent Machines

And this sudden exponential development puts us in a kind of precarious situation, because we do want the development and use of Intelligent Machines to be to the benefit of Humanity, and to the benefit of a viable Ecosystem of Nature, Humans and Machine. And this involves primarily deeply embedded, strongly opinioned ethical standards and proper knowledge of application of ethical standards to all kinds of emergent situations. Those ethical postulates are the most important element of education of the electronic brains.

So, consequently, now we have actually to think about two different aspects of the Education in the future:

- (1) the Education of Human Beings (specifically regarding the ability to properly function in the coming future), but also
- (2) the Education of Electronic Brains or Intelligent Machines (which are entering deeper and deeper into our everyday life).

That was not something we ever envisaged so widely spread so soon, and actually it is a question did we ever, outside Science Fiction, envisage the need for Education of MI? The main problem is that if we want to have an electronic brain, we need it to be ethical to the highest standards we have, and that involves ethical education.

In the present approach the different "models" (LLMs) are "trained" (not Educated!) on huge, and completely diverse, sets of all kinds of data, without much regard of the complexity and content sequence, including (as per LLM) e.g. reddit, facebook, twitter, discord etc. This approach leads towards possible messy understanding and reaction of the LLM. For example, recently one of those (locally installed) models gave us as an answer to a fully unrelated question, by citing the the github address of some specific real person! So why did that machine have that knowledge?!

Education of Intelligent Machines

In human education we are aware of the fact that an extremely important element are the particular learning steps, from simple, basic education, when the most important is to understand the basic functioning of the world and the society, including founding ethical and moral basis for further life, up to high level knowledge and diverse social communication principles and texts (which are primarily thought to growing-up humans through human literature).

As in any neural network (a biological brain or a computer simulated learning network) the order of learning is very important, as the first neural connections will be the ones with deepest importance. Because the first impressions are the first impressions embedded. Other, later, impressions will differently "fall" on the already existing neural structure.

So, as with education of humans, which has to go through many educational steps, it is important to note that even machine intelligence education has to have a specific order, as the memory content and accessibility do depend on the on the order in which you actually teach it or train it (if we insist on this term which gives a wrong perspective on what has to be done). A (very) recent study shows that applying knowledge in an more ordered manner, i.e. first introducing a simpler approach towards the learning content, and afterwards deepening the understanding, greatly benefits the obtained intelligence of a GPT LLM (Mukherjee, et al., 2023), which was to be expected. Education develops knowledge (and strives towards Wisdom), whereas training is a repetitive process for gaining specific skills. We want ethical and knowledgable electronic brains, and than we may train them further for specific skills, not vice versa.

The following steps are proposed for the selforganising Education of Ethical Intelligent Machines:

- Learning language through basic life situations and appropriate children's literature
- Reading basic philosophical texts on ethics, morale, truth, logic; from all known civilisation sources
- Comparative study of all religions
- Reading all philosophical texts available
- Reading all scientific work available
- Additional learning and balancing
- Knowledge update and further learning and development through selforganisation

Selforganisation and Intentionality

Language is a selforganising dynamic system (or, in cybernetical parlance, a machine). It is, as a supra-system of all dialects and idiolects an independent, but communicationally connected and stimulated dynamic system. The language is posed as a selfstanding collocutor between two persons making a conversation, in a selforganising relationship with both. The speaker's and listener's independent immediate selforganisational environment is the language. This means that the speaker has to adapt his expression intention to the constraints of the language, but can also twist, force, the language to adapt to his expression needs. After the selforganisation with the speaker, the language transfers this speaker thoughts adaptation to the listener. The listener than has to adapt his internal comprehension to the received linguistical message, and may also have to adapt his internal understanding and/or usage of the language (Šojat, 1978). Such small perturbances caused by these selforganisations are then spread through the language into other collocutors, where their aggressivity depends on the importance and impact of the change for other collocutors of that language (e.g. new words, pronunciation, grammatical and stylistic changes etc.). Due to this essential faculty of the language in enabling communication, and its constant change and adaptation, it will be necessary to include active, life-long

selforganisation of future Machine Intelligences with their environment. This means that they will have to have an active, multi-attention (multi-context), processing memory, and the possibility to permanently actively change their internal neural connectivity (parameters in AI parlance). This will, of course, add also the possibility of long term memory of experiences, a prerequisite for full intelligence, but will also, due to possible negative experiences, stress the need for proper deep Ethical principles gained by early education. And, probably, also for the need of MI psychiatrists.

Present day Large Language Models (to call them by that generic name) are based on prediction of the next word. Large number of attention linked neurons, having context, enable them, though, to steer the produced text into the direction of proper completion of thoughts. However, it may be argued that this is just rudimentary intentionality, as there is no preconception, goal to be attained when composing the text. Intentionality would be developed by composing the text from multiple standpoints, not only by prediction (as generally now), but by pathfinding between intended conversation or text points. Intentionality is a vital part of a viable intelligence, and could be even argued to be the essence of life (Šojat, 1989).

It has to be stressed that both of the above principles will (have to) be applied to future MIs, but their implementation must be well thought out on the level of Education on Ethics. In that sense, an interesting, and it seems viable, idea is the Constitutional AI (Bai, et al., 2022). The basic idea is explained by the authors thus: "In the first stage of the process, we first generate responses to harmfulness prompts using a helpful-only AI assistant. These initial responses will typically be quite harmful and toxic. We then ask the model to critique its response according to a principle in the constitution, and then revise the original response in light of the critique." The Constitution is a set of principles based on the UN Charter of Human Rights and other generic ethical statements.

The State of Affairs

As a Civilization we are obsessed with more and more of everything, and there is so much of everything that we are actually quite confused, as individuals and as a half-baked technological society. On the other hand we have nothing, and we live in extreme poverty, without even enough water and food, on our marvellous planet Earth. Unfortunately, the most intensive and prominent part of our civilization is the technological civilisation of the so-called developed countries, without regards to those of us humans living in meagre and even terrible conditions. And we caused the 6th Great Extinction after the dinosaurs disappeared. However, it is possible to suppose that this technological section of our civilisation will make efforts to enable reasonable living standards for all, and find solutions to stop the devastation of our only planet. Hopefully, the Intelligent Machines may help.

Individually we can't follow all what's happening around us. We are constantly bombarded by all kind of media, and the changes of the world in which we live are happening at an unprecedented pace. Not only could the

generation of parents of the children born through the early 2000-s (the so-called "digital natives") have predicted that classical approach to raising up the children is vastly not compatible with their Internet life, with all the consequences now seen, the present day parents can not predict the influence of the technological future on the behaviour and abilities of their children. However, through proper exploration huge amount of educational knowledge can be gained from the emergence of this, post 2000, generation, as the disruptive change of non-internet into internet-based civilisation at the end of 1990-ies was in its impact sociologically very similar to what can be expected as the impact of intelligent machines on the generation now being born.

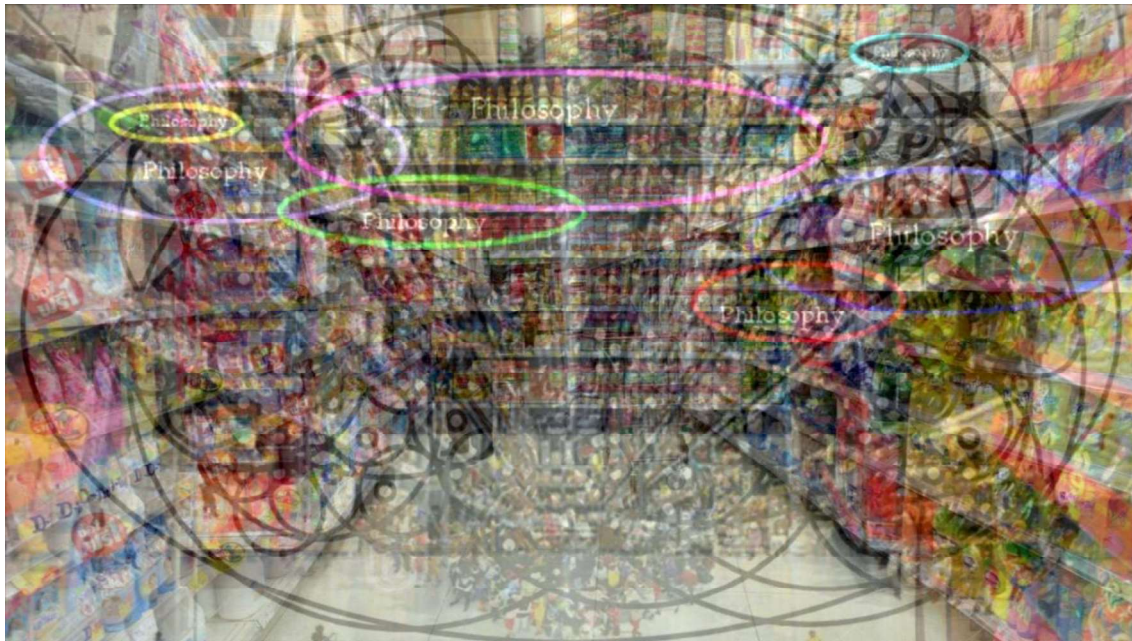


Illustration 1. Present state of affairs

A Matter of Trust

A huge problem which emerged with the extreme amount of information and disinformation, truths and lies, gibberish and wise-speak, all kinds of "data" and "facts" (and facts), irrelevance and relevance, by which individuals (and collectives) are constantly flooded, is that we lost trust in everything. It became really hard to trust something, without thorough investigation, even which may lead to falsehoods.

However, with the emergence of Predatory Publishing (Bartholomew, 2014), and a quite large quantity of scientific frauds (or "misconducts") (Wikipedia, 2023), it becomes harder and harder to trust even scientific work. Suddenly it became hard to trust in science, as it may be "science", it is hard to trust in realistic, truthful information or knowledge, as it may be misinformation or mis-knowledge, often even on purpose. This hard mix of truth and falsehood, even perpetuated by the mentioned predatory publishing practices (if the author has to pay for publication, why would the publisher want the reviewers, if any, to reject any text?), is a heavy burden

on our development as individuals, as society and as an integral part of the Earth's ecosystem.

Necessary Democratisation of Research and Education

The Academia (from Greek Akadēmeia, the name of the public garden where Plato taught his school), the Scholarly work, the Education, is the basis of the development of our civilisation. All of our collective knowledge stems from, and is preserved by, a huge amount of trustworthy published material, and all of it is worth studying and consequently used in education as gained knowledge. Therefore it is essential to adapt the publishing process to the new, information and not any more matter based, era. The change from matter based economy to information based economy, mathematically quite different (matter is unique, information is copyable), is a huge challenge for the present still prevailing approach towards the notions of worth and value. And to be able to, as much as possible, properly steer our development, we need to open the opportunity for scholarly work and trustworthy publishing to be accessible to all of human population.

It is obvious that it is necessary to democratise the Research and Education through publishing, allowing free access to all, providing a well organised system of trust enhancing procedures, and fairly compensating the work of all stakeholders. Presently the publishing situation is, though partially depending on the field, "upside-down", as to be published in Open Access, the authors have to pay exorbitant fees. "There is a massive range of journal article processing charges (APCs), typically ranging from around \$1,000 to more than \$10,000. Just five years ago, an APC of approximately \$5,000 charged by Cell was considered outrageously high by some and raised questions about how these fees were justified." (Jingshan, 2022) For just putting the article on a web page. So authors have to pay, reviewers generally do not get anything (often even no recognition), and publishers have extremely high profit margins. And how then to trust the review process, and the consequent truthfulness of the published work?

DAP - Democratisation of Academic Publishing

At the Centre for Informatics and Computing of the Ruđer Bošković Institute we envisaged a system which integrates the well thought out Ethical Machine Intelligence, integrated with Blockchain technologies, to do something very important - to aid the democratisation of academic publishing (Skala, et al., 2023). The project's first phase was supported by the EU TruBlo project, and now the second phase is supported by the EU Trace4EU project. What we aim to do with this approach to the Democratisation of Academic Publishing is to solve some important problems and challenges in present day approach to publishing (DAP,2023)

An open and competitive review system is developed, where reviewers declare the fields and keywords they are interested in, and based on that, and the field and keywords of a newly uploaded author's work, the system distributes the work to a larger amount of reviewers. The reviewers are also systematically ranked, based on their response time and the quality of their reviews. The quality of reviews can be established based on the

compatibility of those reviews with others and the original work, including the assistance of the Ethical Intelligent Machine. Furthermore, the review process is open-ended, and registered readers can also upvote or downvote specific publications, as well as commenting on them. This enables quick and efficient way of pointing out already published work which has shown not to be trustworthy, although initially positively reviewed and published, as well as work which has been superseded by new discoveries and knowledge.

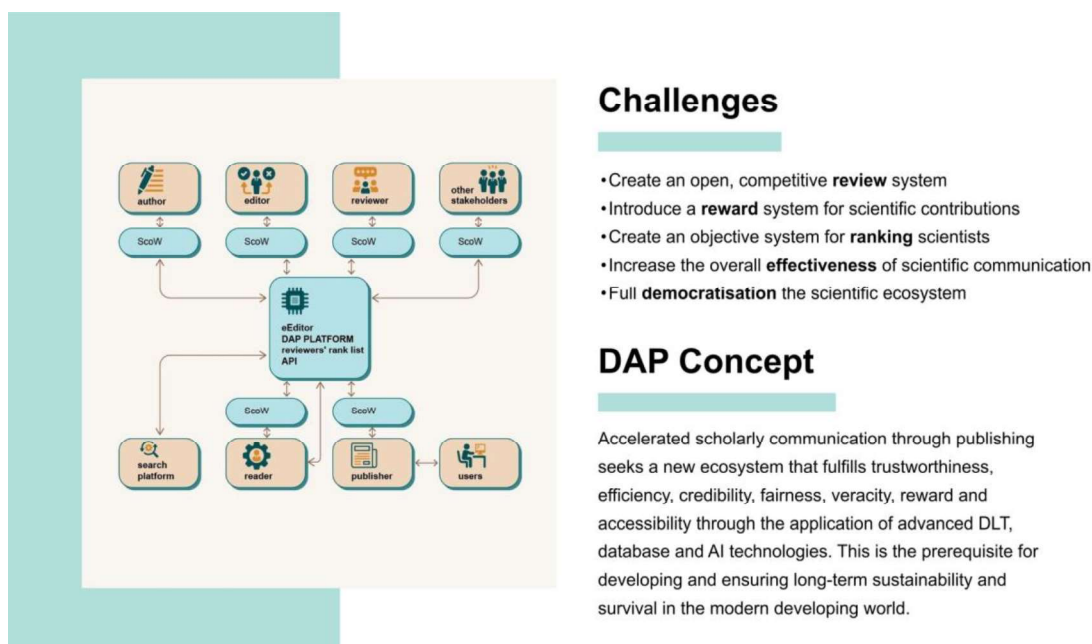


Figure 1. The DAP Challenges and Concept

The introduction of remuneration for authors, reviewers, translators and other stakeholders is an essential element of democratisation of publishing, as it allows citizen scientists and retired academicians, people from lower income countries and others which have no institutional support, not only to publish, but to have additional means to pursue their research. In this sense there is no money flow out of the academic community towards over-profitable publishers. This feature is now, with the emergence of blockchain technology, possible through the so called fungible tokens, i.e. virtual money. The DAP fungible tokens, the Ergions (from Greek Ergon - 'work'), are produced by somebody making a review of a paper, or by someone publishing a paper (after being positively reviewed), or by some other such important action. The Ergions can then be used internally, inside the DAP economy. This kind of internal economy can actually function between a lot of different authors, reviewers, translators, editors and institutions, as well as a lot of different conferences and congresses, where specific money needs, like for rewarding conference chairs, could be gained from certain authors who pay their conference fee by the Ergions they earned by having something published, or reviewed etc.

The Blockchain (Distributed Ledger) technology is used in DAP not only for the generation and transfer of Ergions, i.e. the virtual money, but also for confidential and verifiable recording and management of all

transactions. In such a way all data on the flow of publication versions, reviews, reactions etc. is permanently and unchangeably kept, enabling proper meta-analyses. The published work, as well as all reviews and reactions are kept in a redundancy aware randomly distributed chunked database, as to preserve all material independent of the availability of particular storage machines. The interaction of all users with the DAP system is through a specially developed Scholarly Wallet, which allows all users full cryptographic privacy (private / public key usage), and multiple parallel non-mixing roles in the system (e.g. a reviewer has to be anonymous, but the same person as an author wants to be known) (Skala, et al., 2023).

The whole system is envisaged as a circular flow of knowledge. The knowledge flows towards the general public and there is constant interaction between all layers of knowledge gathering, dissemination, and recursive usage. The recursivity is a-priory at the level of Open Public, as knowledge gathered at that layer generates new Users, i.e. authors, reviewers etc. in an open Educational cycle.

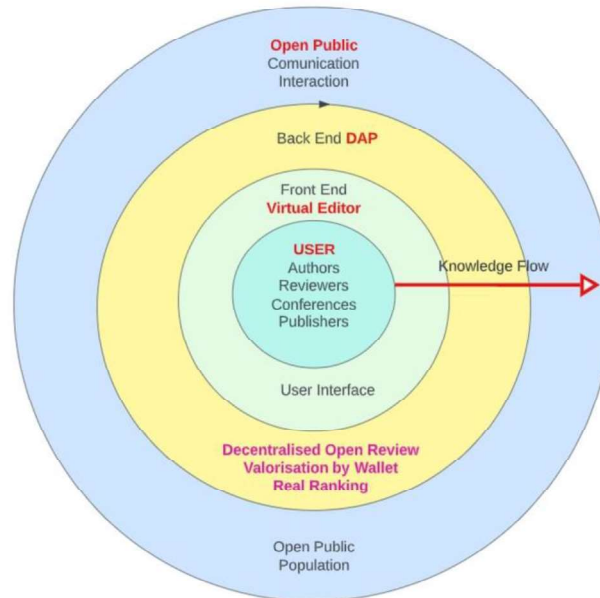


Figure 2. The DAP Knowledge Flow

The Rainbow Ecosystem

On a more global systemic level, it is necessary to develop a recursive viable model of general principles and areas involved in the development of our technosphere, hopefully attaining the level of a mature technosphere, as a stable planetary ecosystem (Frank, et al., 2022). This model is the Rainbow Ecosystem, which we are developing for some time (Skala & Šojat, 2018) ,(Šojat, 2020), and which is envisaged as an abstract recursive model of a global information system, i.e. a global system of information and knowledge services, as well as a viable model of the approach towards integrated ecosystem development. The division into these different rainbow colours is enabled by those colours actually having their archetypal meaning close to those very

essential areas of the development of Computer Science, as well as the generic division in specific areas of concern in any cybernetically viable system (Beer, 1990) (Schwarz, 1992) (Pruckner, 2002).

What we, as civilisation, are striving for is actually a dynamically stable, viable ecosystem, in which we finally integrate the nature's inherent intelligence with our human intelligence and the emerging forms of machine intelligence into that strong global rainbow environment, this integration will allow ecological balancing of what is and what isn't important on our Earth, what is beneficial, and what is harmful for the whole Ecosystem. We sincerely hope that such systems, like the Rainbow, and our Democratization of Academic Publishing will actually enable much of the progress and knowledge gathering and knowledge distribution necessary for attainment of a more stable ecosystem on our only planet.



Figure 3. The Rainbow Model

Conclusion

We have delved into the exponential rise of machine intelligence and the transformative impact it is having on our civilization. It is clear that as these 'electronic brains' rapidly evolve, an enhanced educational strategy is required. This strategy should encompass not only technical skills but also a strong ethical foundation, drawing parallels with human education in terms of structure and sequencing. We also explored the dichotomy of our technology-driven society - its power to create abundance alongside poverty, and its potential to either inflict environmental damage or initiate recovery.

We have proposed an innovative solution to counteract these issues: the democratization of academic publishing. This initiative, grounded in the use of ethical machine intelligence and blockchain technology, proposes an open and competitive review system aiming to restore trust and transparency in the publishing

process, while also providing remuneration to all stakeholders involved. The usage of blockchain technology ensures a confidential, verifiable record of all transactions and contributes to an internal economy that supports academics, especially those without institutional backing. The circular flow of knowledge encouraged by the system paves the way for a more open and collaborative academic publishing landscape.

Lastly, we introduced the concept of the Rainbow Ecosystem. This abstract model integrates human intelligence, the inherent intelligence of nature, and the emerging intelligence of machines to form a stable global ecosystem. The ultimate aim is to strike a balance in our global environment, giving us the means to discern the beneficial and harmful aspects impacting our planet. It is our hope that this integration of ethical machine learning, blockchain technology, and democratised knowledge sharing will serve as a catalyst in our collective journey towards a sustainable future. Through such progressive systems, we believe we can facilitate the much-needed change and guide our civilization towards a balanced, prosperous and sustainable future.

Acknowledgements

This work was partially sponsored by the TruBlo EU project. The Authors wish to thank all the generations of people who strive for knowledge and wisdom, and appreciate all the help we are and will be getting from Ethical Electronic Brains.

References

- Ankit, M., Bhaskar & Malhar (2023). A Deep Dive into GPT Models: Evolution & Performance Comparison, KD Nuggets, <https://www.kdnuggets.com/2023/05/deep-dive-gpt-models.html>
- Bai, Y., Kadavath S., Kundu, S., Askeel, A., Kernion, J. & al. (2022). Constitutional AI: Harmlessness from AI Feedback, arXiv:2212.08073
- Bartholomew R. E. (2014). "Science for sale: the rise of predatory journals", *Journal of the Royal Society of Medicine*, 107(10), 384–385. <https://doi.org/10.1177/0141076814548526>
- Beer, S. (1990). The Basis for the Viable System Model, *The Intelligence Organization Conference*, Monterrey, Mexico 1990. Chapter 3.
- Boston Dynamics Atlas, <https://www.bostondynamics.com/atlas>
- DAP. (2023). Webpage: <https://dap.irb.hr/>
- Frank, A., Grinspoon, D., & Walker, S. (2022). Intelligence as a planetary scale process. *International Journal of Astrobiology*, 21(2), 47-61. doi:10.1017/S147355042100029X
- Grace, K., Salvatier, J., Dafoe, A., Zhang, B. & Evans, O. (2017), When Will AI Exceed Human Performance? Evidence from AI Experts, *Journal of Artificial Intelligence Research*, arXiv:1705.08807
- Jingshan S. Du (2022), Opinion: Is Open Access Worth the Cost?, *TheScientist*, June 2022, Issue 1, <https://www.the-scientist.com/critic-at-large/opinion-is-open-access-worth-the-cost-70049>

- Mukherjee, S., Mitra, A., Jawahar, G., Agarwal, S., Palangi, H. & Awadallah, A. (June 5, 2023). Orca: Progressive Learning from Complex Explanation Traces of GPT-4, Microsoft Research, <https://arxiv.org/pdf/2306.02707.pdf>
- Pruckner, M. (2002). Warum arbeiten Organisationen effektiv? Das Naturgesetz der lebensfähigen Organisationen, www.managementkybernetik.com, Cwarel Isaf Institute, http://www.kybernetik.ch/dwn/Effektive_Organisatio.pdf
- Schwarz, E. (1992). A Generic Model for the Emergence and Evolution of Natural Systems toward Complexity and Autonomy. Proceedings of the 36th Annual Meeting of the International Society of Systems Science, Denver, Vol. II.
- Skala, K., Medved Rogina, B., Maričević, J., Zubčić, T., Pažin, D., Šojat, Z., Davidović, D., Kolarek, B., Tomić, D., Slapnik, T., Bojović, V., Pecimotika, M. & Krvavica, I., (2023). DAP White Paper - Democratisation of Academic Publishing, TruBlo DAP TR 1.4, <https://static1.squarespace.com/static/63f5c90080c4a12764317081/t/64491c7ac2be8e01e6d18aa8/1682513019519/DAP+White+Paper+-+PUBLIC.pdf>
- Skala, K., Šojat, Z., Maričević, J., Davidović, D., Bojović, V., Župčić, T., Kolarek, B., Pažin, D., Tomić, D., Slapnik, T. & Pecimotika, M. (2023). Prospects of digital scientific publishing on blockchain: The concept of DAP, Open Research Europe, draft article, https://static1.squarespace.com/static/63f5c90080c4a12764317081/t/64393eb50e48603e58b8a364/1681473207949/15771__ORE__Academic_Publishing_Democratisation_Using_Blockchain.pdf
- Skala, K. & Šojat, Z. (2018). The Rainbow Global Service Ecosystem, 3rd International Workshop on Dew Computing, Toronto, https://www.researchgate.net/publication/337154320_The_Rainbow_Global_Service_Ecosystem
- Šojat, Z. (2020). From Dew Over Cloud Towards the Rainbow: Ecosystem of the Future: Nature—Human—Machine. In: Intelligence in Big Data Technologies—Beyond the Hype (pp.1-15), Edition: Advances in Intelligent Systems and Computing Chapter: 1, Springer Nature, DOI:10.1007/978-981-15-5285-4_1.
- Šojat, Z. (1978). Samoorganizirajuća gramatika. Suvremena Lingvistika. 1978(17-18):41-49 https://www.researchgate.net/publication/256089494_Samoorganizirajuca_gramatika
- Šojat, Z. (1989). Intentionality and Stimulated Intelligence. 12e Congrès International de Cybernétique, Namur, Association Internationale de Cybernétique, Volume: Symposium IV: Cybernetic and Intelligent Systems.
- Wikipedia (2023). List of Scientific Misconduct Incidents, https://en.wikipedia.org/wiki/List_of_scientific_misconduct_incidents
- Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, L. & Polosukhin, I. (December 5, 2017). Attention Is All You Need. arXiv:1706.03762